

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference 21540PCTHShw | FOR FURTHER ACTION See Form PCT/IPEA/416 | |
| International application No. PCT/SE2004/000811 | International filing date (day/month/year) 26-05-2004 | Priority date (day/month/year) 27-05-2003 |
| International Patent Classification (IPC) or national classification and IPC G05D1/02, B25J9/16 | | |
| Applicant STOCKHOLMSMÄSSAN AB ET AL | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

| | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

| | |
|---|---|
| Date of submission of the demand 21-12-2004 | Date of completion of this report 25-08-2005 |
| Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 | Authorized officer Gordana Ninkovic /LR Telephone No. +46 8 782 25 00 |

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/000811

Box No. I Basis of the report

1. With regard to the language, this report is based on:



the international application in the language in which it was filed



a translation of the international application into _____,
which is the language of a translation furnished for the purposes of:



international search (Rules 12.3(a) and 23.1(b))



publication of the international application (Rule 12.4(a))



international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:



the international application as originally filed/furnished



the description:

pages 1 - 14 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____



the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 15 - 19 received by this Authority on 30-06-2005

pages* _____ received by this Authority on _____



the drawings:

pages 1 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____



a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:



the description, pages _____



the claims, Nos. _____



the drawings, sheets/figs _____



the sequence listing (*specify*): _____



any table(s) related to the sequence listing (*specify*): _____

4. ☐

This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).



the description, pages _____



the claims, Nos. _____



the drawings, sheets/figs _____



the sequence listing (*specify*): _____



any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2004/000811

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|-------------|-----|
| Novelty (N) | Claims | <u>1-22</u> | YES |
| | Claims | | NO |
| Inventive step (IS) | Claims | <u>1-22</u> | YES |
| | Claims | | NO |
| Industrial applicability (IA) | Claims | <u>1-22</u> | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1 US 2002156556 A1 (B.J.RUFFNER), 24 October 2002
D2 WO 03014852 A1 (SIEMENS AKTIENGESSELLSCHAFT), 2 February 2003
D3 WO 0106905 A1 (THE PROCTER & GAMBLE COMPANY), 1 February 2001
D4 US 5896488 A (J-Y.JEONG), 20 April 1999
D5 EP 0562559 A1 (SANYO ELECTRIC CO.,LTD.), 29 Sept 1993
D6 JP4365104 A (TOSHIBA CORP), 17 December 1992

Documents D1 and D2 are reconsidered to represent the state of the art, together with remaining documents D3-D6.

Document D1 discloses a multifunctional mobile robot system where a user can place the mobile appliance in a work area bounded by a set of impulse radio, GPS, or transceivers. The appliance independently and accurately maps the work area and proceeds to perform one or more tasks over that area, as directed by the user. It is equipped with sensors and inertial navigation means to enable it to avoid obstacles and identify its position with respect to the operating conditions (see [0078], [0089], [0090], [0119], [0132]; abstract; figures 1,2,10).

Document D2 discloses a system of the programming an autonomous mobile, which temporarily cannot traverse a subsection of a predefined path. The system maps out an extended route for the mobile to traverse the discovered obstacle. The mobile returns later back to the defined path point for performing working task, if the obstacle no longer is blocking the path (see page 1, lines 30-34).

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: BOX V

However, none of the cited documents discloses a robot system for treating a surface, including at least one mobile robot comprising locating and emitting means and method for treating a surface according to claims 1 and 12.

In view of the cited documents such a method and a system cannot be considered obvious to a person skilled in the art.

Therefore the invention claimed in claims 1 - 22 is novel and considered to involve an inventive step.

What is claimed in claims 1 - 22 is considered to be industrially applicable.

Claims

1. Robot system including at least one mobile robot (10), for
treating a surface, which comprises map storage means to
store a map of the surface to be treated and means to navi-
gate the, or each, mobile robot (10) to at least one point on a
surface, characterized in that the, or each, mobile robot (10)
comprises locating means (13,14) to identify its position with
respect to the surface to be treated, means to automatically
deviate the mobile robot away from its initial path in the event
that an obstacle is detected along its path, means to store
and/or communicate data concerning the surface treatment
performed and any obstacles detected by the locating means
(13,14) and emitting means (15) that produce emissions (17)
such as symbols, lines, shapes, or written characters in one
or more colours for treating at least one point on a surface.
2. Robot system according to claim 1, characterized in that said
emitting means (15) are arranged to dispense at least one of
the following: ink, paint, glue, a gas, a liquid, a powder or
light to mark, etch, decorate or chemically react with the sur-
face to be treated.
3. Robot system according to claim 1 or 2, characterized in that
the, or each, mobile robot (10) comprises an on-board com-
puter (12) including map storage means and means to store
and/or communicate data concerning the surface treatment
performed and any obstacles detected by the locating means
(13,14).
4. Robot system according to any preceding claims, character-
ized in that the, or each mobile robot (10) is programmed to
return to an area in which an obstacle was detected after a
pre-determined time to check whether the obstacle is still
present and whether it is therefore still hindered from
performing surface treatment in that area.

- 5 5. Robot system according to any preceding claims, characterized in that the locating means (13,14) comprise at least one of the following types of sensor; optical such as a laser, thermal imaging, electro-magnetic, sonar, GPS, pressure, motion, angle detection, contact or direction sensors.
- 10 6. Robot system according to any preceding claims, characterized in that it comprises means to differentiate between different objects or different parts of the same object by detecting differences in the reflectivity of the different materials constituting those objects.
- 15 7. Robot system according to any preceding claims, characterized in that the, or each, mobile robot (10) comprises wired or wireless communication means such as an electric or optic cable, an antenna or Bluetooth™ hardware to communicate with a remote user, control system or computer network or another robot.
- 20 8. Robot system according to any preceding claims, characterized in that the communication means are arranged to report that an obstacle has been encountered by a mobile robot (10) if the obstacle has not been removed after a pre-determined
- 25 time such as a few seconds.
- 30 9. Robot system according to any preceding claims, characterized in that the, or each, mobile robot (10) traverses the surface to be treated.
- 35 10. Robot system according to any of claims 1-8, characterized in that the, or each, mobile robot (10) traverses a surface other than the surface to be treated.
11. Robot system according to any preceding claims, characterized in that the, or each, mobile robot (10) com-

prises deletion means, instead of, or in addition to the emitting means (15), which are arranged to remove emissions (17) produced by the emitting means (15) of the same or another mobile robot (10) in the same or a previous run respectively.

12. Method for treating a surface using a robot system including at least one mobile robot (10), comprising inputting a map of a surface to be treated into a computer (12) located on-board or remotely to the, or each, mobile robot (10), navigating the, or each, mobile robot to at least one point on a surface, characterized in that the, or each, mobile robot (10) draws up a map of the surface using information collected from on-board or remote locating means (13,14) used to identify the position of the robot with respect to the surface to be treated and automatically deviates away from its initial path in the event that an obstacle is detected along its path, that the, or each, mobile robot (10) stores and/or communicates data concerning the surface treatment performed and the obstacles detected by the locating means (13,14) and that emissions (17) such as symbols, lines, shapes, or written characters in one or more colours are produced by emitting means (15) for treating at least one point on the surface.

13. Method according to claim 12, characterized in that map data and, if available, path data is inputted in the form of a file such as a file from a CAD-system.

14. Method according to claim 12 or 13, characterized in that the, or each, mobile robot (10) is programmed to return to an area in which an obstacle was detected after a predetermined time to check whether the obstacle is still present and whether it is therefore still hindered from performing surface treatment in that area.

15. Method according to any of claims 12-14, characterized in that the, or each, mobile robot (10) is instructed to return to areas in which an obstacle was identified after the obstacle has been removed.
- 5
16. Method according to any of claims 12-15, characterized in that one or more points or parts of a permanent structure having a complex geometry and located in the working area of the, or each mobile robot (10) is marked with
- 10 reflective material, such as reflective tape, to strengthen the signals reflected from said points or parts to facilitate correspondence between data from the locating means and data from the robot system's map.
- 15 17. Computer program product, characterized in that it contains computer program code means for making a computer or processor carry out the method according to any of claims 12 to 16.
- 20 18. Computer program product according to claim 17, characterized in that it is stored by means of a computer-readable medium such as a data server, magnetic or magneto-optical storage means.
- 25 19. Computer program product according to claim 17 or 18, characterized in that it further comprises instructions for the emitting means (15) used to treat the surface.
- 30 20. Computer program product according to any of claims 17-19, characterized in that it contains a map of a surface and optionally a pre-programmed path to direct the, or each, mobile robot around that path.
- 35 21. Use of a robot system according to any of claims 1-12, a method according to any of claims 13-16 or a computer program product according to any of claims 17-20 for indi-

cating or marking out a physical lay-out on any indoor or outdoor surface such as at an exhibition, a trade fair or construction site.

- 5 22. Use of a robot system according to any of claims 1-12, a method according to any of claims 13-16 or a computer program product according to any of claims 17-20 for marking out a physical lay-out at a site under hazardous or hygienic conditions.

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